

WHAT IS CLAIMED IS:

1. A nonlinear process circuit configured to perform a nonlinear transformation of a nonlinear input signal, comprising:

a main circuit configured to form the nonlinear input signal into a first nonlinearly-processed signal using a first function which has an approximate linear characteristic divided into a plurality of intervals; and

an assistant circuit configured to form the first nonlinearly-processed signal into a second nonlinearly-processed signal using a second function which has an approximate linear characteristic in which each of the intervals is divided into two connected line segments.

2. The nonlinear process circuit according to claim 1, wherein the main circuit comprises:

a decision circuit configured to determine a particular interval out of the intervals in which the nonlinear input signal falls;

a signal-generation circuit configured to form the nonlinear input signal into a plurality of first processed signals for each of the intervals;

a plurality of main processing circuits corresponding to respective of the intervals, each of the main processed circuits configured to multiply the first processed signals inputted into the respective intervals by predetermined coefficients to form second processed signals; and

a first addition circuit configured to add the second processed signals resulting from multiplication processes in the respective intervals, the first addition circuit forming the first nonlinearly-processed signal.

3. The nonlinear process circuit 1 according to claim 2, further comprising:

a storage circuit configured to store the predetermined coefficients.

4. The nonlinear process circuit according to claim 1, wherein the assistant circuit comprises:

a second addition circuit configured to add a processed correction value to the first nonlinearly-processed signal.

5. The nonlinear process circuit 1 according to claim 2, wherein the assistant circuit comprises:

an assistant storage circuit configured to store a correction amount to be added to the first function, and

the assistant circuit is configured to read the correction amount of the selected interval from the assistant storage circuit, and to form the second function having characteristics in which the correction amount is added to at a midpoint of the selected interval of the first function such that a point at which the correction amount has been added is set as a maximum gain and the correction amount decreases toward start and end points of the selected interval.

6. The nonlinear process circuit according to claim 5, further comprising:

a storage circuit configured to store correction amounts for respective of the intervals;

wherein the assistant storage circuit is configured to read the correction amount of the selected interval from the storage circuit.

7. The nonlinear process circuit according to claim 3, wherein the assistant circuit comprises an assistant storage circuit configured to store a correction amount to be added to

the first function and a direction value indicating a direction in which the correction amount is to be added, and

the assistant circuit is configured to read the correction amount for the selected interval from the assistant storage circuit, and to add the correction amount to a midpoint of the selected interval of the first function in a direction of the direction value read from the assistant storage circuit to form the second function having characteristics in which a point at which the correction amount has been added is set as a maximum gain and in which the correction amount decreases toward start and end points of the selected interval.

8. The nonlinear process circuit according to claim 7, further comprising:

a storage circuit storing correction amounts and direction values for respective of the intervals;

wherein the assistant storage circuit is configured to read the correction amount and the direction value of the selected interval from the storage circuit.

9. The nonlinear process circuit according to claim 1, wherein the first function and the second function have  $\gamma$  characteristic for processing a nonlinear signal used for an image signal.

10. A method for performing a nonlinear transformation of a nonlinear input signal, comprising:

(a) forming the nonlinear input signal into a first nonlinearly-processed signal using a first function which has an approximate linear characteristic divided into a plurality of intervals; and

(b) converting the first nonlinearly-processed signal into a second nonlinearly-processed signal using a second function wherein plural of the intervals have an approximate linear characteristic divided into two connected line segments.

11. The method according to claim 10, wherein step (a) comprises:  
determining a particular interval in which the nonlinear input signal falls;  
forming the nonlinear input signal into a plurality of first processed signals for respective of the intervals;  
multiplying the first processed signals by predetermined coefficients to form second processed signals; and  
adding the second processed signals to form the first nonlinearly-processed signal.

12. The method according to claim 10, wherein step (b) comprises:  
adding a correction value derived using the second function to the first nonlinearly-processed signal.

13. The method according to claim 11, wherein step (b) comprises:  
adding a correction value derived using the second function to the first nonlinearly-processed signal.

14. The method according to claim 12, wherein step (b) comprises:  
reading from a memory, which stores gain correction amounts for respective of the approximate linear characteristic of the plurality of intervals of the first function, a stored gain correction amount corresponding to the approximate linear characteristic of said particular interval; and

forming the second function by adding to a midpoint of said particular interval the read gain correction amount to set a point at which the second function in the particular interval has a maximum gain over the first function in the particular interval.

15. The method according to claim 12, wherein step (b) comprises:

reading from a memory, which stores gain correction amounts and respective correction directions for respective of the approximate linear characteristic of the plurality of intervals of the first function, a stored gain correction amount and correction direction corresponding to the approximate linear characteristic of said particular interval; and

forming the second function by adding to a midpoint of said particular interval the read gain correction amount in the read correction direction to set a point at which the second function in the particular interval has a maximum gain over the first function in the particular interval.

16. The method according to claim 13, wherein step (b) comprises:

reading from a memory, which stores gain correction amounts for respective of the approximate linear characteristic of the plurality of intervals of the first function, a stored gain correction amount corresponding to the approximate linear characteristic of said particular interval; and

forming the second function by adding to a midpoint of said particular interval the read gain correction amount to set a point at which the second function in the particular interval has a maximum gain over the first function in the particular interval.

17. The method according to claim 13, wherein step (b) comprises:

reading from a memory, which stores gain correction amounts and respective correction directions for respective of the approximate linear characteristic of the plurality of intervals of the first function, a stored gain correction amount and correction direction corresponding to the approximate linear characteristic of said particular interval; and

forming the second function by adding to a midpoint of said particular interval the read gain correction amount in the read correction direction to set a point at which the second function in the particular interval has a maximum gain over the first function in the particular interval.

18. The method according to claim 10, comprising:

using first second functions which define a  $\gamma$  characteristic for processing a nonlinear image signal.

19. A computer program product storing instructions which when executed by a computer causes the computer to implement a method for performing a nonlinear transformation of a nonlinear input signal, said method comprising:

(a) forming the nonlinear input signal into a first nonlinearly-processed signal using a first function which has an approximate linear characteristic divided into a plurality of intervals; and

(b) converting the first nonlinearly-processed signal into a second nonlinearly-processed signal using a second function wherein plural of the intervals have an approximate linear characteristic divided into two interconnected line segments.

20. The computer program product according to claim 19, wherein step (a) comprises:

determining a particular interval in which the nonlinear input signal falls;  
forming the nonlinear input signal into a plurality of first processed signals for  
respective of the intervals;  
multiplying the first processed signals by predetermined coefficients to form second  
processed signals; and  
adding the second processed signals to form the first nonlinearly-processed signal.

21. The computer program product according to claim 19, wherein step (b) comprises:  
adding a correction value derived using the second function to the first nonlinearly-  
processed signal.

22. The computer program product according to claim 20, wherein step (b) comprises:  
adding a correction value derived using the second function to the first nonlinearly-  
processed signal.

23. The computer program product according to claim 21, wherein step (b) comprises:  
reading from a memory, which stores gain correction amounts for respective of the  
approximate linear characteristic of the plurality of intervals of the first function, a stored  
gain correction amount corresponding to the approximate linear characteristic of said  
particular interval; and

forming the second function by adding to a midpoint of said particular interval the  
read gain correction amount to set a point at which the second function in the particular  
interval has a maximum gain over the first function in the particular interval.

24. The computer program product according to claim 21, wherein step (b) comprises:

reading from a memory, which stores gain correction amounts and respective correction directions for respective of the approximate linear characteristic of the plurality of intervals of the first function, a stored gain correction amount and correction direction corresponding to the approximate linear characteristic of said particular interval; and

forming the second function by adding to a midpoint of said particular interval the read gain correction amount in the read correction direction to set a point at which the second function in the particular interval has a maximum gain over the first function in the particular interval.

25. The computer program product according to claim 22, wherein step (b) comprises:

reading from a memory, which stores gain correction amounts for respective of the approximate linear characteristic of the plurality of intervals of the first function, a stored gain correction amount corresponding to the approximate linear characteristic of said particular interval; and

forming the second function by adding to a midpoint of said particular interval the read gain correction amount to set a point at which the second function in the particular interval has a maximum gain over the first function in the particular interval.

26. The computer program product according to claim 22, wherein step (b) comprises:

reading from a memory, which stores gain correction amounts and respective correction directions for respective of the approximate linear characteristic of the plurality of intervals of the first function, a stored gain correction amount and correction direction corresponding to the approximate linear characteristic of said particular interval; and

forming the second function by adding to a midpoint of said particular interval the read gain correction amount in the read correction direction to set a point at which the second

function in the particular interval has a maximum gain over the first function in the particular interval.

27. The computer program product according to claim 19, wherein the method comprises:

using first and second functions which define a  $\gamma$  characteristic for processing a nonlinear image signal.